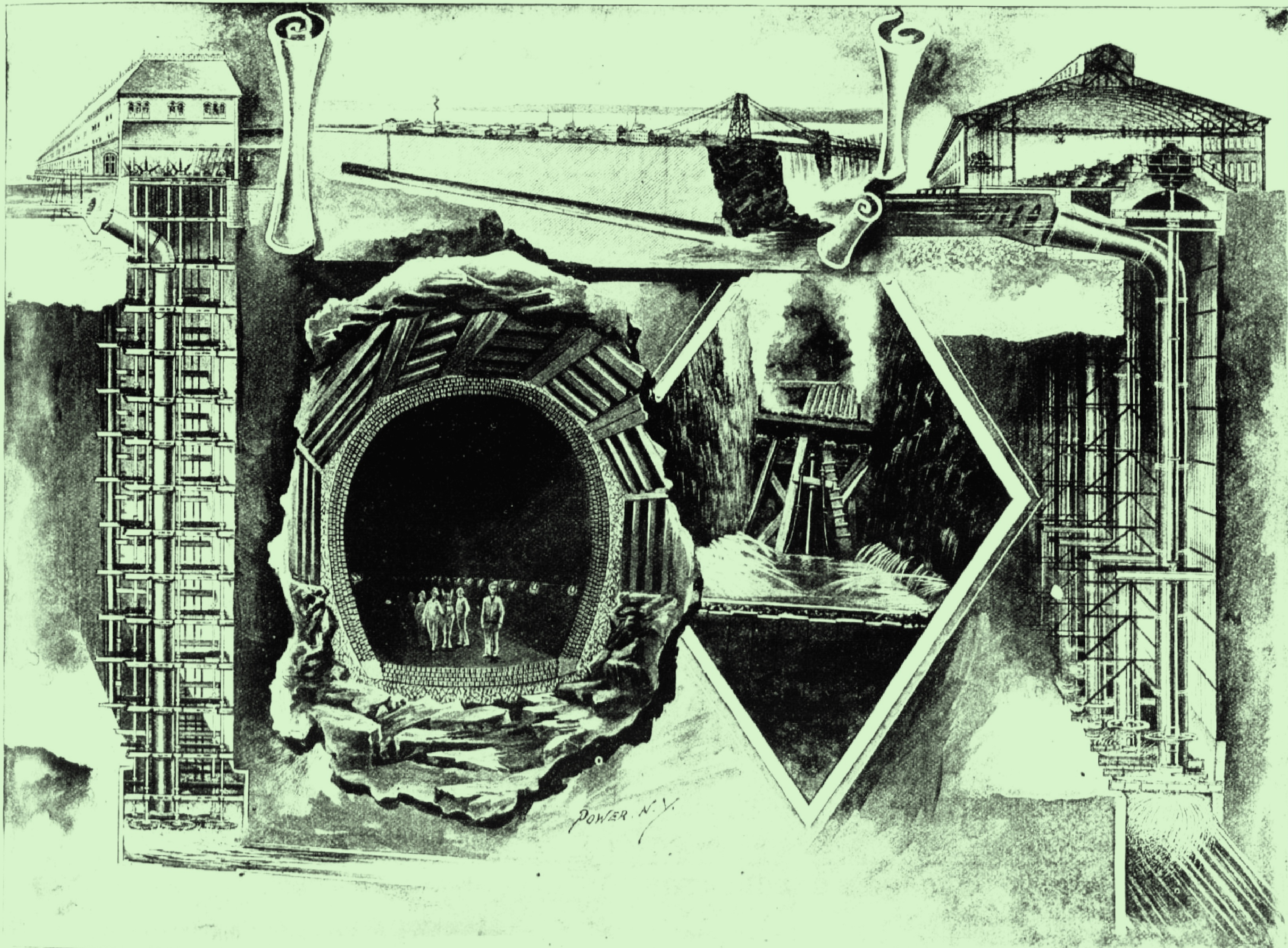


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THE GREAT TUNNEL FOR UTILIZING A PART OF THE WATER POWER OF NIAGARA FALLS.

## THE GREAT TUNNEL AT NIAGARA.

THE feasibility of developing the heretofore little utilized but enormous power of the water in its rapid course toward the great falls has been to an extent demonstrated by the work accomplished by the Niagara Falls Power company, though the proportion of the total power which will be used in connection with present preparations is so small a fraction of the whole available power that it is not expected to

make a perceptible difference in the flow over the falls. According to the census of 1880, the steam and water horse-power employed in the manufactures carried on in the United States was 3,410,837 of which 2,185,458 was steam power and 1,225,379 water power. The estimated total power of the falls has been, by the most conservative, placed at several million horse-power, at least double that of the total combined steam and water

power at present employed in the United States.

The central feature of the work accomplished and which forms the subject of the accompanying illustrations, is the great tunnel, 7,600 feet long, forming the tail race, starting from the river at just above the water level, below the falls and running under the village of Niagara, at a depth of 200 feet below the surface of the ground, the upper end of the tunnel being beneath a

large tract of land, owned by the Company, adjacent to the river bank above the village. The tunnel has somewhat of a horseshoe shape, being 19 feet wide by 21 feet high inside of the brickwork with which it is lined throughout. It was, at first, intended to allow the rock, through which it passed to form the wall of the tunnel but it was found necessary, from the nature of the rock and the amount of water encountered, to line it with brick.



This has been done in the manner shown in the engraving, the lining being 16 inches in thickness and requiring about 15,000,000 bricks. The space between the brickwork and the rock was filled with broken stone, and cement, the supporting timbers being built in as shown. The lining has reduced the capacity of the tunnel from 120,000 horse power at first contemplated, to about 100,000 horse-power. It has a cross-sectional area of 365 square feet for its entire length. Its grade is about one foot in 150 and there is a difference of about 200 feet in the level of the water in the canal and the tunnel discharge, about 140 feet of which will be available as working head for the turbines.

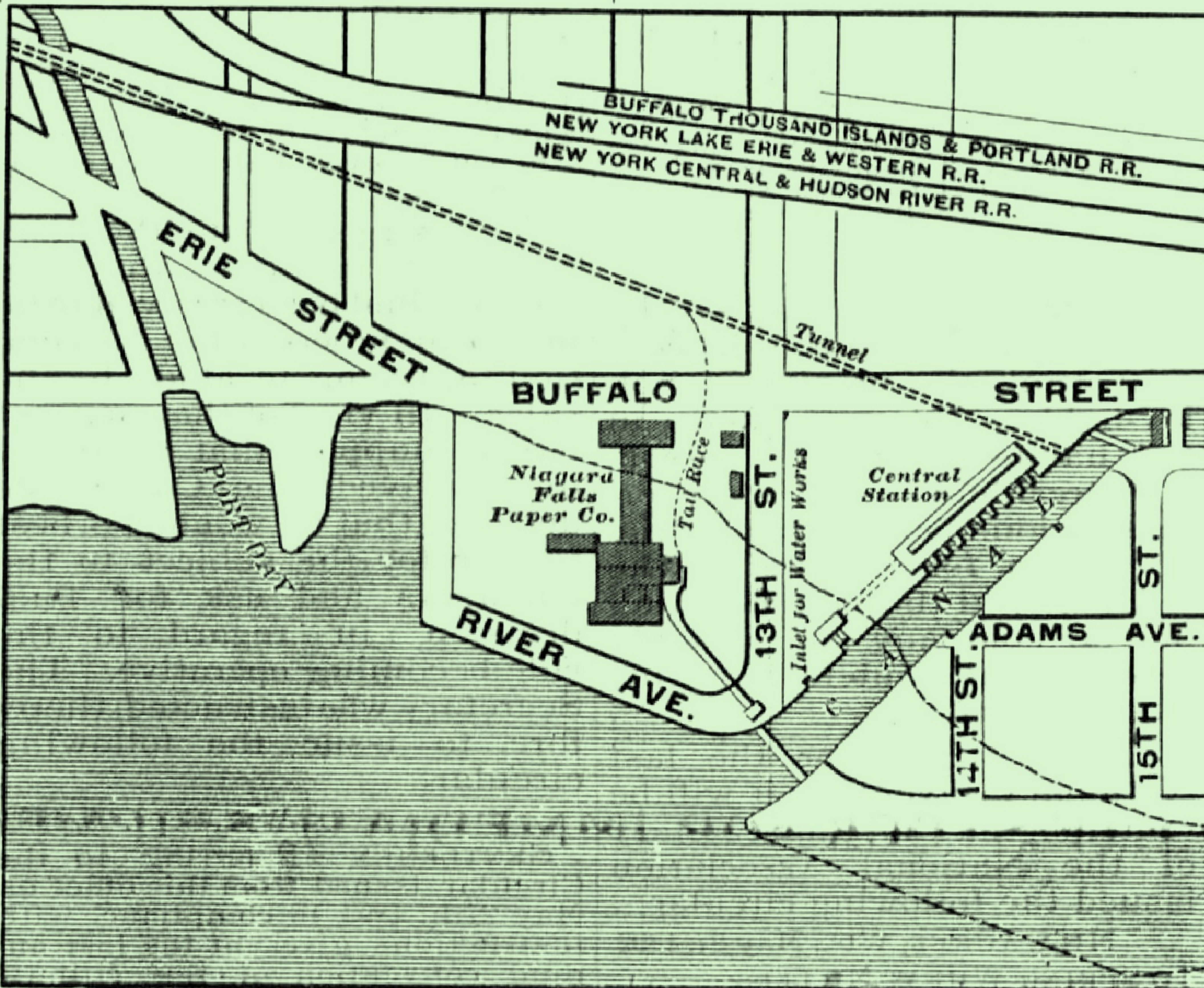
To the manufacturer who locates at Niagara, two methods of procuring power are available. He may either put in his own wheel-pit, penstock and wheels, and discharge the water into the tunnel as a tail-race, or he may equip his factory with electric motors and obtain his current from the immense power house which the Company will construct and operate.

The first establishment to put in an installation upon the first mentioned plan will be the Niagara Falls Paper Co., who are building what will be the largest paper mill in the world, it will be situated as shown on the map, upon reclaimed land at the river side. The water taken from the canal as shown, will be delivered through a single penstock upon six turbines and discharged through a supplementary tunnel, some 800 feet in length, to the main tunnel. From each turbine a vertical shaft extends to the mill above, connecting, through bevel gears, with the pulp-grinding and other machines and shafting. A general idea of the arrangement is shown at the left of the large engraving.

This method of utilizing the power of Niagara will be practicable only for industries of considerable magnitude. For the smaller manufacturer the electric motor, supplied with cheap current from the large power house, where it can be most economically generated, will doubtless be the less costly arrangement. To meet this demand the Niagara Falls Power Co., are putting in a station at the location shown on the map. Here will be installed, primarily, two turbines of 5,000 horse-power each. The vertical shaft of the turbines will carry at their tops the armatures of two multipolar dynamos, to utilize the capacity of the wheel. The weight of the bearings is supported by the pressure of the water under the running head.

This station is so designed that it can be extended to an ultimate capacity of 50,000 horse-power. The projected arrangement is shown in general at the right in the large engraving. The wheel-pit is 150 feet in length and 18 feet in width; the difficulties encountered from in-rushing water are suggested in one of the panels of the engraving, which is reproduced from a photograph. The construction of a coffer-dam and the continual operation of powerful pumps were found necessary to the prosecution of the work.

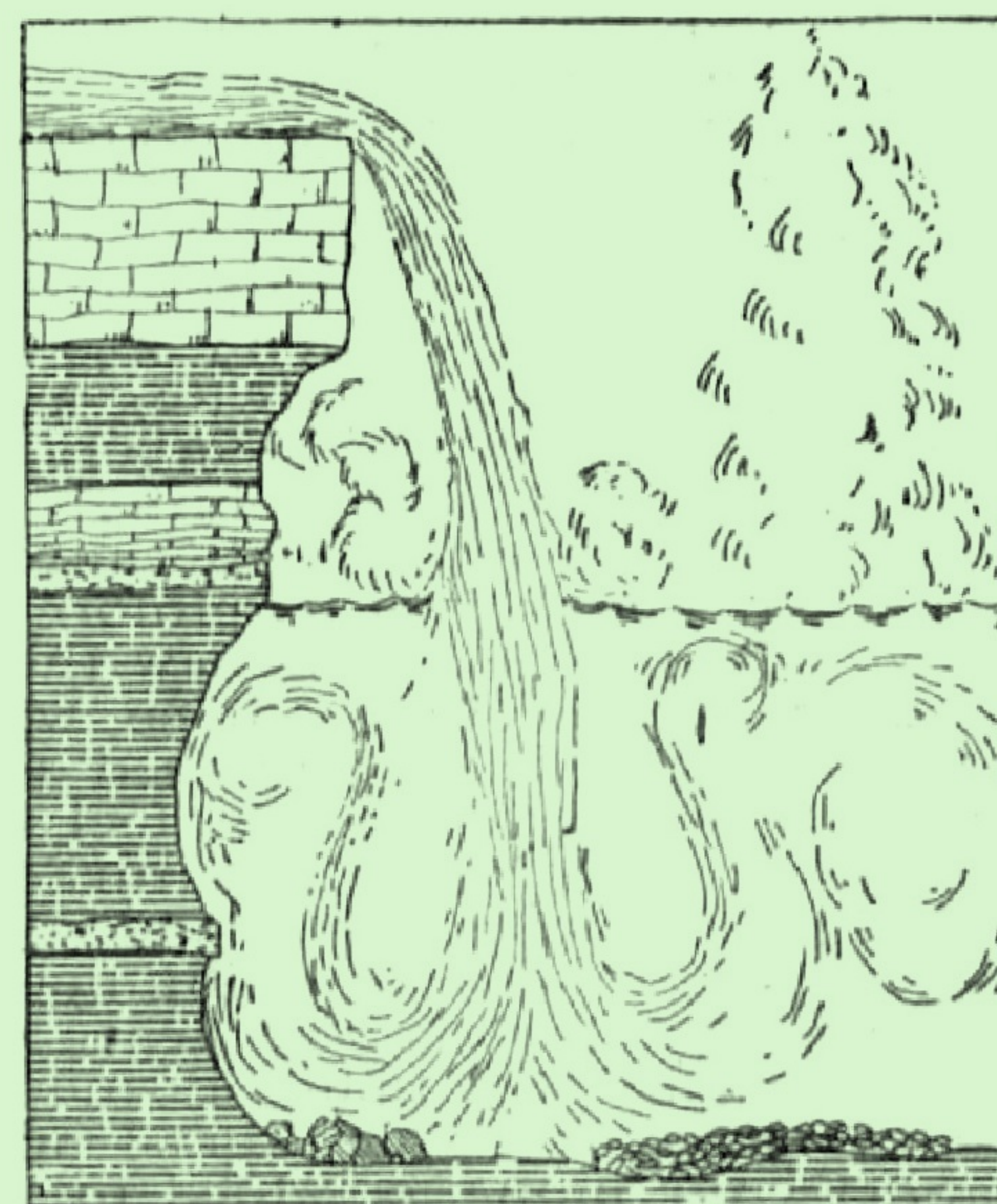
stallments will be ready to start before Spring. This tunnel will develop one of the most remarkable powers in the world, and it is prophesied that the country between Buffalo and the Falls will, in time, become one of the largest manufacturing centers ever known. The September number of *Power*, to the publishers of which we are indebted for the use of accompanying illustration and the substance of this article, concludes its description with "A bit of Niagra's very ancient history," including the following:



CANAL AND FACTORIES AT HEAD OF TUNNEL.



BIRD'S-EYE VIEW OF NIAGARA GORGE.



SECTION OF NIAGARA FALLS.

Referring to the map, the positions of that portion of the canal now in progress and the main tunnel are indicated. The canal will be extended along Buffalo street or Adams avenue as shall appear most desirable when the character and location of the industries, which will use it, shall have been determined, the tunnel being extended accordingly. The dotted line indicates the original shore line, which will be extended to the shore lines shown. Although the main tunnel is practically complete and ready for thy water, none of the power in-

"At first Lake Erie discharged across the divide where the city of Fort Wayne now stands, running into the Wabash River, and thence into the Ohio and Mississippi. The channel of this discharge and the elevated shore lines of that time are well preserved. In course of time the ice, which had filled the Ontario basin, retreated northward, exposed a lower outlet in western New York, in the neighborhood of Oneida Lake, and the waters of the great lakes emptied into the Mokaw, where Rome is now, and thence into the Hudson. This change lowered the surface of Ontario some 550 feet, thereby separating it from Lake Erie and gave rise to Niagara River. Ontario is now about 300 feet lower than Erie, but the land between them is an almost level

plain until near Lake Ontario, where there is a bluff, shown at the bottom of the bird's-eye view. On this bluff, about where Lewiston now stands, Niagara Falls first "set up in business," on a small scale, an unknown number of years ago."



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